COMMENTS OF

UTILEX, Inc.
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MAY 16 1996

in response to the

FEDERAL COMMUNICATIONS COMMISSION
NOTICE OF PROPOSED RULEMAKING

regarding

Implementation of the Local Competition Provisions in the Telecommunications Act of 1996, CC Docket No. 96-98.

Comments prepared by
C.J. Cain
President

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14 May 1996

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Overview

In work fully sponsored by the U.S. Department of Energy under Small Business Innovation Research (SBIR) grant number DE-FG05-90ER81004, UTILEX, Inc. has developed and field-proved a new real-time telephonic technology which we intend to make widely available to telecommunications companies, utility companies, and other service providers. Our field trials with two telcos have shown both the technical feasibility and the competitive desirability of unbundling the local loop into "sub-loops," and we offer the observations below in support of rules which we believe will encourage competition by expressly permitting such further unbundling and interconnection.

We have been able to show that by using out-of-band signalling in only the outermost (nearest the subscriber) segment of subscriber loops, ordinary existing telephone networks can exchange data, text or control signals with hundreds of customer sites <u>per second</u> at any time--even while the loops are in use, whether for voice, FAX, modem or other services--without affecting the network nor subscribers' service. In two years of DOE-sponsored field trials in two North Carolina towns, prototype systems have successfully demonstrated several capabilities valuable to electric, gas and water utilities, providing a reliable full-time link with their customers and their distribution systems while taking full advantage of the ubiquity, security and reliability of the existing telephone infrastructure. In addition to utility applications, however, this approach has broad significance to the telecommunications industry and to the public interest: it provides a full-time, real-time, two-way "gateway" to new consumer services such as home automation and energy management; gives telecommunications providers (telephone and cable) important new remote loop isolation/testing capabilities, cost-reduction and revenue opportunities; and provides a smooth migration path to future broadband deployment.

A key element of our patented approach is interconnection to that segment of the local loop which is nearest the subscriber: out-of-band signalling can be used in this sub-loop without affecting, or being affected by, the switch or any other traffic or service which the loop may be carrying. Our comments therefore address the proposed rules for interconnection and loop unbundling (esp. see NPRM para. 97), both of which will directly affect the deployment of this new technology. In what follows we will respectfully urge that the Commission implement rules which

- treat the local loop as a physical entity ("network element") separable from the services or functions it may provide;

- unbundle the local loop into one or more logical and technically feasible portions ("sub-loops") where applicable;

- expressly permit interconnection to the sub-loop at distribution points where the subscriber's line terminates or joins the upstream network.

We will also cite our experience and field trial results showing that such interconnection is technically feasible. We believe that such rules will not only stimulate other new service offerings, but will also permit--and simplify--simultaneous interconnection to the local loop or sub-loop by several disparate service providers.

Brief description of our technology

Two characteristics of the telephone switch have heretofore prevented telephone networks from providing real-time access to remote points in the network: the switch is slow, requiring several seconds to access each point; and it prohibits access to any loop which is offhook. Were it not for these drawbacks, the public switched network--ubiquitous, reliable, and secure--could be used for numerous new real-time services in addition to providing traditional point-to-point connection of voice and data.

Our Bridge to Broadband™ is a new combination of known elements which avoids these switch-induced constraints, effectively and economically providing an independent, non-dialed communications channel which can send and receive data to and from large numbers of remote points per second using ordinary existing subscriber loops, whether onhook or offhook. This bidirectional channel is available at all times, and has no effect on the network or upon telephone service.

As shown in Figure 1, the system has two components:

1) a Service Control Point (SCP), capacitively coupled to each loop at a network distribution point from which numerous loop segments disperse to individual subscribers, and

2) a Customer Interface Unit (CIU), capacitively coupled to each loop at the subscriber's premise.

A service provider can access any SCP at any time by any of several conventional telephonic means (our field trials used an ordinary dialup line to each SCP and provided a six-character password for security). Once the SCP is accessed, the service provider controls it <u>via</u> its access line, causing it to relay commands, data or text to, or collect data from, any or all of the CIUs which are connected to its loops at the subscriber sites. The SCP typically draws its low operating power from its own access line, and can thus continue operating even during utility power outages--a useful feature for many applications, as will be shown below.

The bidirectional communication between the SCP and its CIUs is out-of-band, ensuring (1) that any loop can be accessed at any time, (2) that an onhook line can be accessed without causing the switch to take it offhook, and (3) that the SCP/CIU communication is inaudible to any subscriber whose telephone is in use (offhook.) Our field-trial systems achieved excellent results using simple FSK at 20 and 22kHz, modulated at 1200 bits/second; early scouting tests had shown that higher frequencies could be used, and of course more

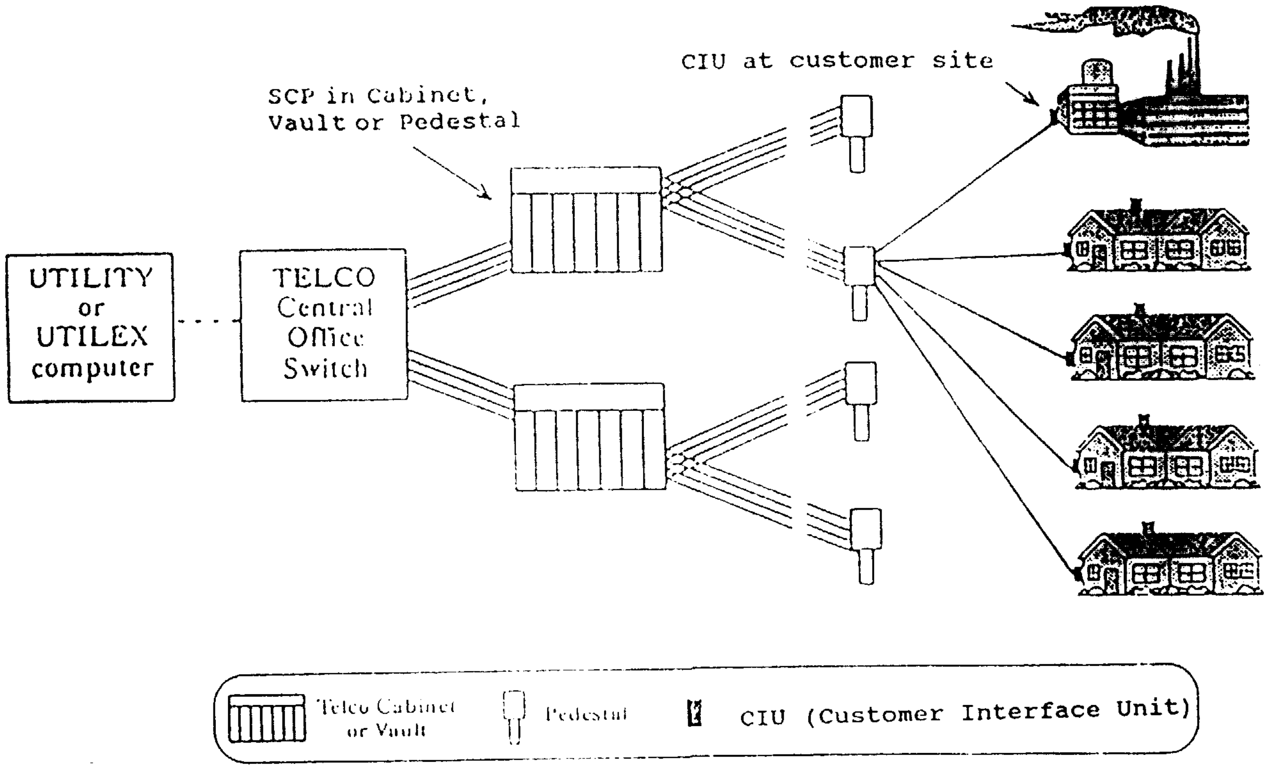

Figure 1: Overview of the Bridge to Broadband™

sophisticated signalling schemes can permit higher data speeds. Signal levels used were -18dBm, which we showed could suffice for distances of up to 15 kft. Because load coils block all but in-band signals, the SCP is placed on the subscriber side of the outermost load coil in the loop.

A single SCP can control CIUs at as many as several thousand sites; modular construction will ensure that the cost per loop is essentially constant whether the area being served is urban (densely populated) or rural (sparsely populated.) Because the remote sites are not individually dialed the SCP can access large numbers of them very rapidly.

Upon command from its SCP, the CIU collects data (e.g., utility metering data, measurements of voltage, current, pressure, equipment status, alarm inputs, customer inputs, etc.) from appropriate sensors at the customer site; opens or closes switches at the site; or channels text to a visual display on the customer's premises (even during power outages if the display is given a backup battery.) Any CIU can be accessed at any time or interval, permitting real-time measurements without storing data at the remote site. Moreover, the CIU can be commanded to disconnect the subscriber's telephone line (e.g., at the Network Interface Device), dial into telephone central office test equipment over the subscriber loop, and place test signals on the loop: new capabilities which permit improved loop testing, automated loop inventory, service quality monitoring, and supervisory control--important benefits and cost savings to most telcos.

Summary of field trial results

Our SBIR project was to demonstrate real-time metering of electricity, and met or exceeded all its objectives. We installed CIUs on 24 residences in Shallotte, North Carolina and on three residences and three industrial plants in Rocky Mount, North Carolina. (Our field-trial SCPs were arbitrarily designed to accommodate six loops; four SCPs were used in Shallotte and three in Rocky Mount.) Working with two utility companies and two telephone companies gave us varied experience and showed that our technology was transportable between networks. In each town the system obtained consumption and demand information from existing residential and industrial meters using dial-reading encoders and pulse initiators; meter sites were accessed as often as 288 times daily (every five minutes around the clock.) Each system was controlled automatically by a desktop 386 computer 20 miles from the test site and running only DOS 5.0 and ProComm, continuously producing ASCII files compatible with popular spreadsheets and text editors. No proprietary software was used.

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(cont.)

Our prototype systems were successfully tested on ordinary, existing subscriber lines served by four types of switches (1A, 5E, DMS-100, and a Stromberg-Carlson); on loaded and non-loaded loops; on direct copper and pair-gained lines; on lines serving inexpensive instruments, multiple extensions and cordless phones; on a line crossing a substation fence *via* an isolation transformer; and at one industrial plant, on a line serving a coin-operated telephone. Excellent results were obtained in each case, with no measurable effect on network performance or service. Subscribers participated voluntarily and were given no incentives of any kind. Only one subscriber comment was received: our first installations were at two adjacent residences having a total of five (!) cordless phones, and these subscribers reported a faint background noise on some of their instruments. Careful lab studies using similar phones and dissimilar controls allowed us to find and permanently remove the cause, as confirmed by both subscribers. The systems operated normally through numerous severe lightning storms, high humidity, and measured internal temperatures above 130F; twelve units in a beachfront community also operated normally despite prolonged exposure to salt air. We experienced only two problems from lightning and power surges: after one SCP was damaged three times by lightning the telco found that its access loop had no protector; a utility power surge opened the protective fuses on six CIUs simultaneously. Both situations were analyzed, corrected, and never recurred.

These prototype systems demonstrated several important benefits to the utility industry: flexible Time-of-Use metering; real-time outage detection and reporting; real-time load profiling at any demand interval; real-time measurement (not simply confirmation) of the results of remote load management; and conventional monthly "automatic meter reading"--all in real time; at industrial and residential sites; without special meters or load recorders; under the full control of a utility computer; and without proprietary software. (See Appendix 1 for some of these results.) The same equipment can also remotely and rapidly control loads, monitor and control remote equipment, collect various types of data unrelated to metering, and display text even during power outages or other emergencies--continuousely, and at numerous remote sites per second.

Interconnection/unbundling considerations

Because our approach employs out-of-band signalling only on the segment of the local loop which is nearest the subscriber, it connects to the loop at a point often quite distant from the switch, making it useful on long and/or loaded loops. It seems likely that other providers will benefit from similar access, and indeed telcos themselves have long attached pair-gain and other equipment to such points.

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(cont.)

We submit that our field trials have amply demonstrated the technical feasibility of interconnecting to, and communicating over, the "sub-loop" nearest the subscriber. We believe that rules which permit such unbundling of the loop will promote competition for new services on this and perhaps other segments of the largely underutilized local loop, and that these services will benefit not only utilities (as we have shown), but incumbent telcos, other service providers, and the public interest. To this end, we rrspectfully urge that the Commission treat the local loop not as a single entity from the switch to the subscriber premise, but as a series of unbundled sub-loops; expressly permitting interconnection to the sub-loop at distribution points where the subscriber's line terminates or joins the upstream network. We therefore believe that structures housing LEC network facilities on public rights of way, (vaults, cabinets, pedestals and the like) should be deemed to be part of LEC "premises" (NPRM para. 71.)

Presuming that the connected equipment complies with 47 CFR 15 and 68, we believe such interconnection should be expressly and routinely permitted except where the incumbent telco shows that it would interfere with an <u>existing</u> or <u>subscriber-requested</u> service on any loop in question. We have found that some telcos, reluctant to permit interconnection within the loop, cite the possibility not that the network will be harmed but that the proposed new service might complicate the future deployment of services for which there is little or no present demand. This can result in delaying new services which new entrants could be providing, or in imposing unrealistic economic burdens on the new entrant by requiring, in effect, a demonstration of compatibility with all possible future services, however speculative. We agree with the Commission's tentative conclusion (NPRM para. 55.1) that "the party alleging harm to the network [should] present detailed information to support such a claim," but we suggest that the Commission extend this principle, perhaps as above, to help competitive providers provide new services in a timely and economical fashion.

Whereas various State actions have required unbundling the local loop itself (<u>e</u>.<u>g</u>., North Carolina's H.B. 161 of 1995, now incorporated in NC G.S. 62-2) we believe that by expressly requiring the unbundling of sub-loops the Commission will more effectively stimulate competition. Moreover, we agree with the Commission's tentative conclusion (NPRM para. 50) that "uniform interconnection rules [will] facilitate entry by competitors in multiple states by removing the need to comply with a multiplicity of state variations in technical and procedural requirements.

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(cont.)

We also respectfully urge that the local loop and its constituent sub-loops be treated as physical entities, separate and distinct from any traffic they might carry or service they might provide. This will expressly provide innovators with the greatest latitude and is most likely to stimulate new viewpoints and new competition. In addition, future services may be entirely unlike any presentday uses of the loop, making the latter irrelevant (and possibly an unwarranted burden by affecting interconnection pricing.) By contrast, defining the loop in terms of its functions or services is likely to discourage, rather than generate, fresh ideas and new uses for the loop. This is particularly true since only its present functions and uses are yet known, and any such "bundled" definition would create difficulties and require change as new uses are developed.

Finally, we note that by unbundling sub-loops and defining them as physical entities the Commission will stimulate the development of new industry relationships and pricing structures, many of which will promote efficiency and benefit consumers and the national interest. For example, telcos and electric utilities are often among each others' largest customers and have many similar interests, but as yet they have shown little interest in collaboration to reduce costs or improve efficiency through innovative use of energy management, advanced uses of telecommunications, or shared infrastructures. We confidently expect the deployment of our technology to stimulate such collaboration between these industries, giving them combined savings and benefits which will be reflected in new jointly-derived tariffs. If physical sub-loops are unbundled, new service providers will doubtless create similar opportunities in other fields.

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by

C.J. Cain
14 May 1996

Appendix 1

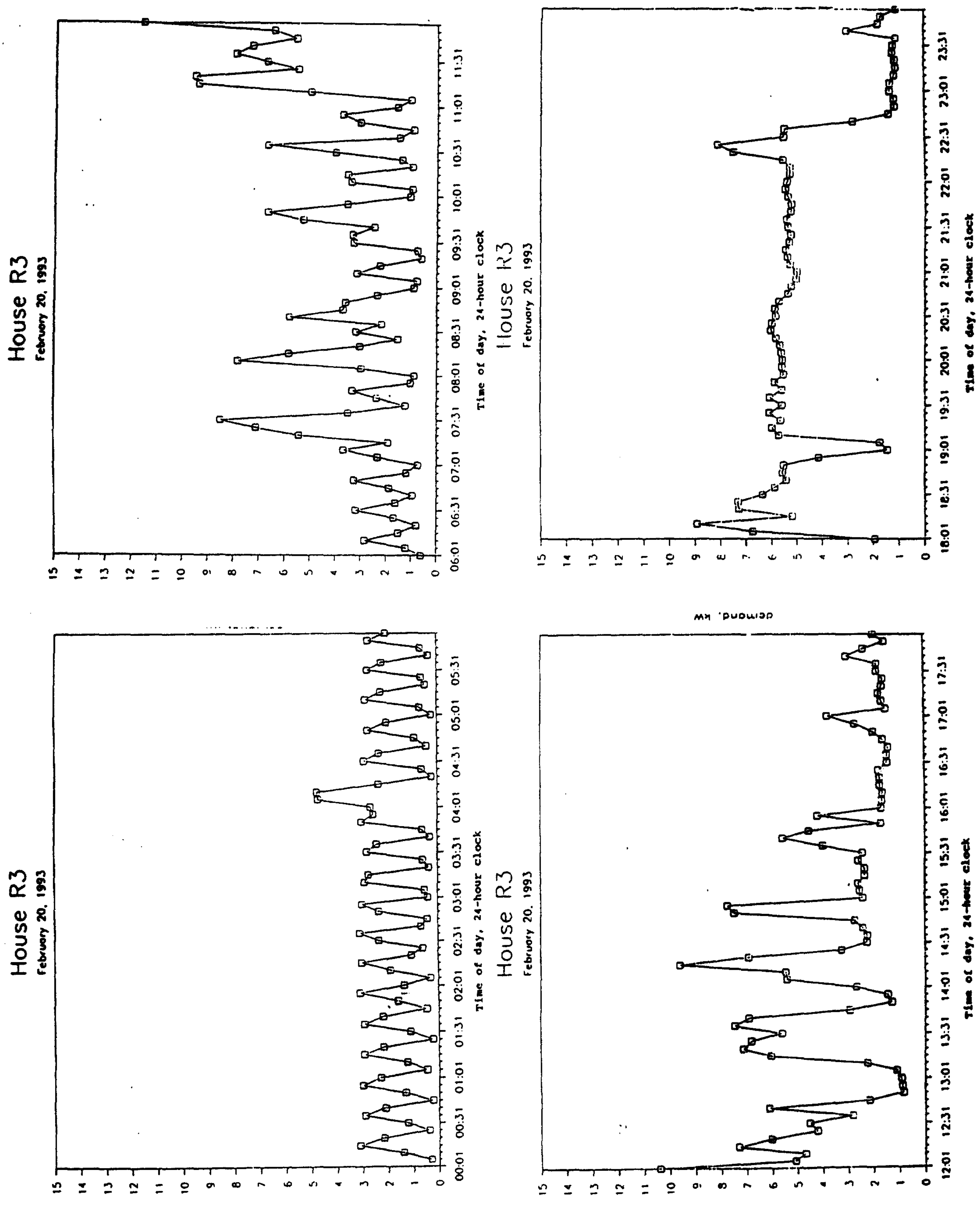
The following examples from our DOE-sponsored field trial show some of the many utility functions that can be performed in real time at many locations per second. All data were obtained by a desktop computer twenty miles from the test sites via the subscribers' ordinary, existing telephone lines, even while the lines were in use. No special meters, load recorders or proprietary software were used.

Example 1:

Real-time load profiles from ordinary meters

This continuous profile of five-minute demand was obtained in real time from an ordinary General Electric I-70 residential watthour meter _via_ the customer's existing telephone line equipped with UTILEX's Bridge to Broadband^{tm} real-time telemetry system. Such profiles were obtained under the automatic control of a desktop computer running only DOS and ProComm. At no time was any customer disturbed, nor was the use of his/her telephone affected.

Each data point represents electrical demand over a five-minute interval; the system communicated with customers' meters at five-minute intervals around the clock (288 times daily) for many weeks during the field trial.



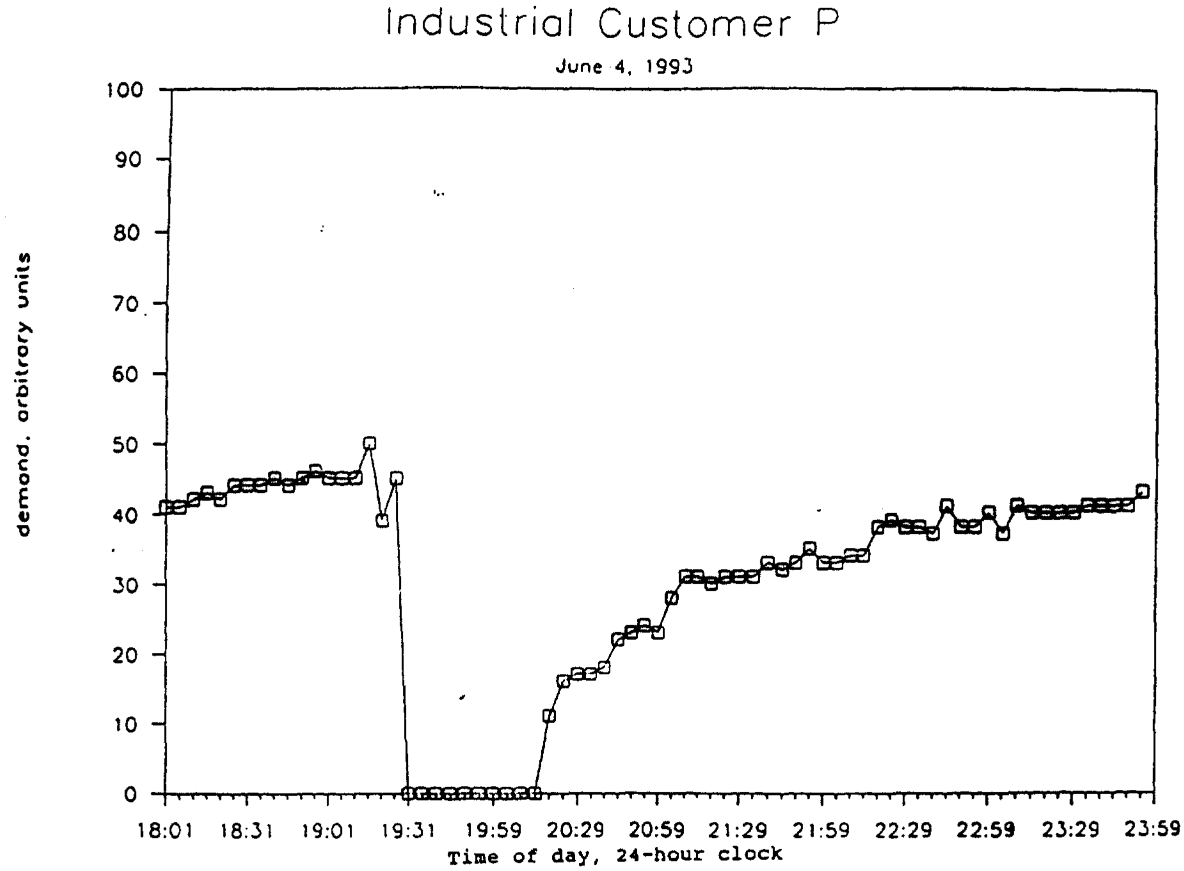
Real-time five-minute demand profile, residence R3
data taken from ordinary watthour meter (no recorder)
directly into central location twenty miles away

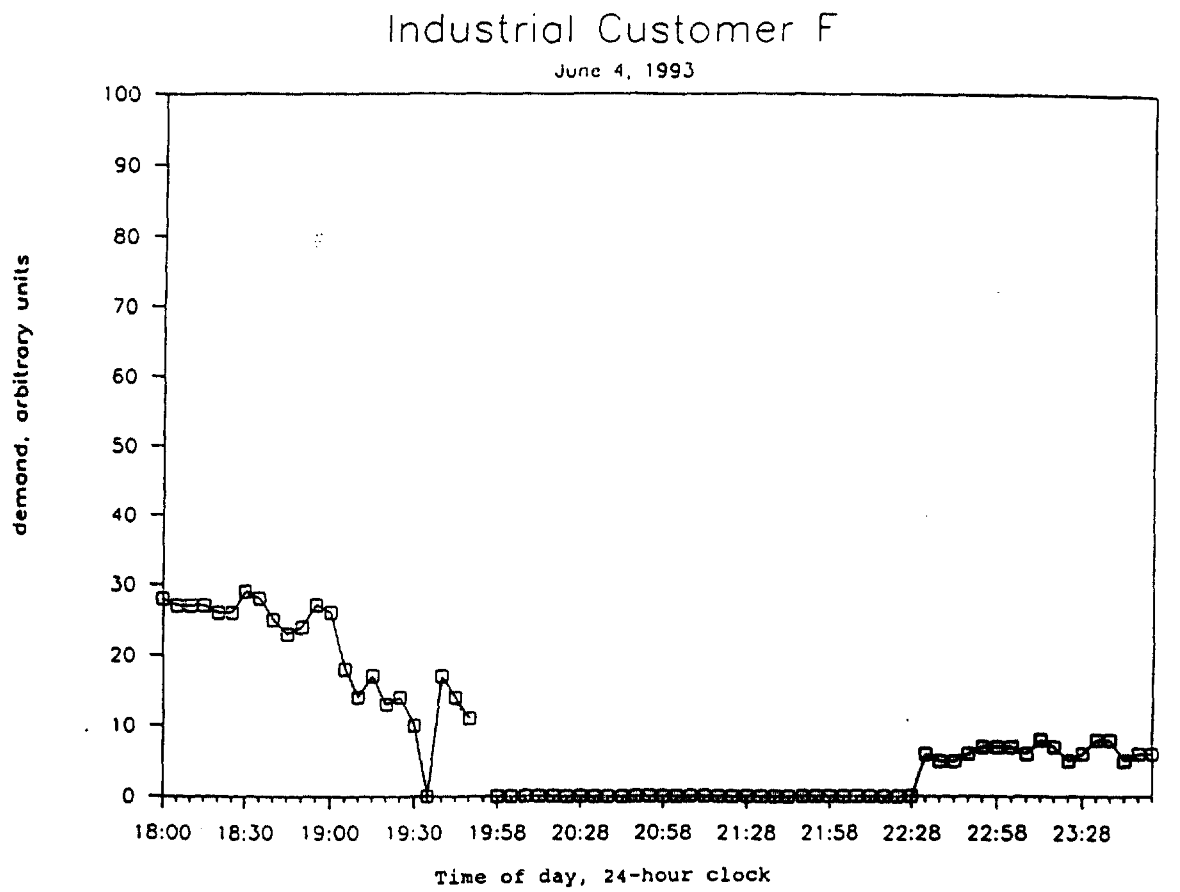
Example 2:

Automated power outage detection

Operating throughout a severe storm which shut down 80% of the electrical distribution system of one of our test towns, our telemetry system monitored in real time, from twenty miles away, the onset, duration and clearing of simultaneous power outages at three industrial plants, two of which are shown here. The outage at the third location (not shown) lasted 58 hours, yet was also profiled in its entirety by the system.

Coupled with a computer mapping system, such information can produce an immediate map of the outage without relying on customers to call in. Moreover, the system can send messages for display at any or many customer locations even during a power outage.





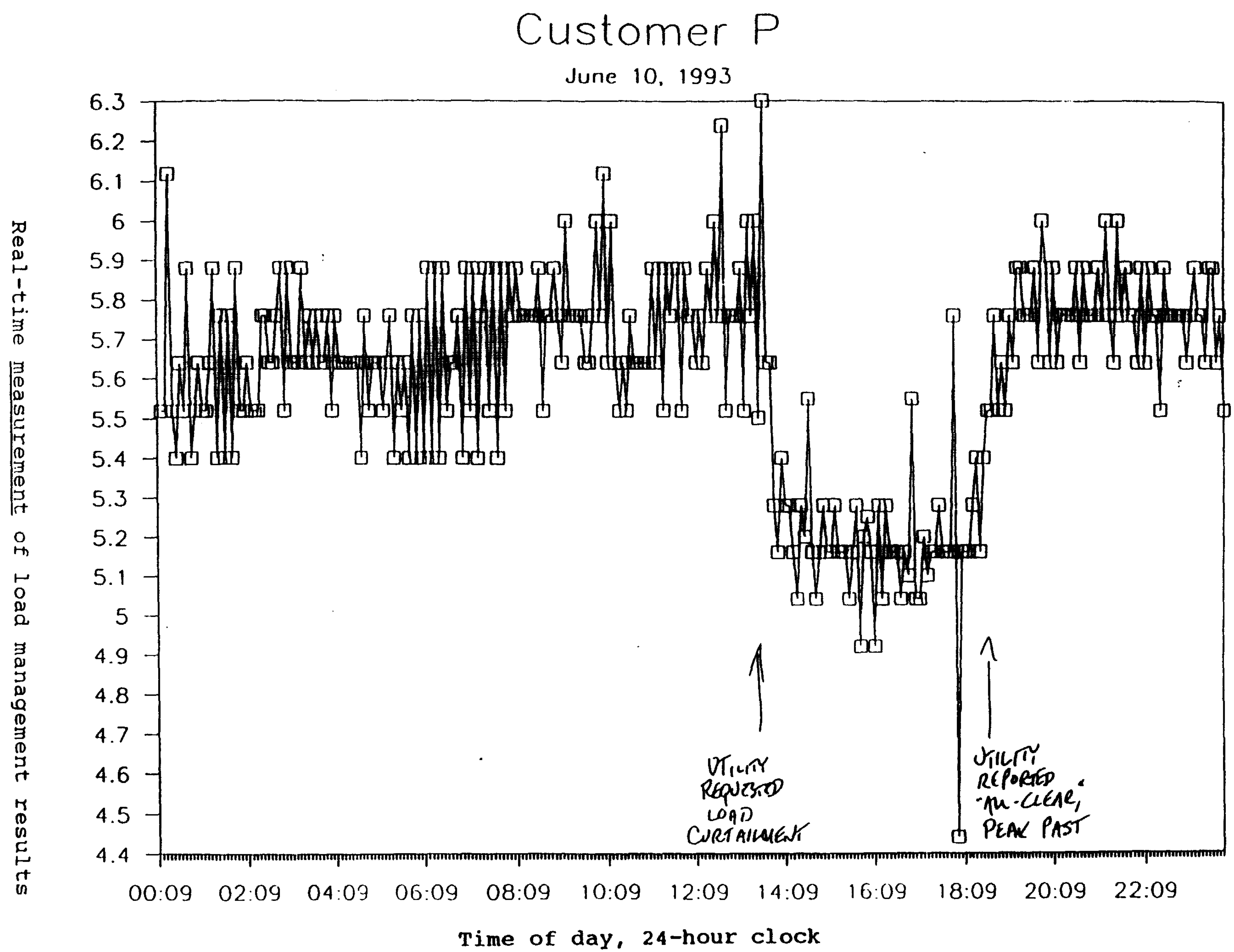
: An actual power outage monitored in real time at two industrial locations by a UTILEX computer twenty miles away

Example 3:

Immediate <u>measurement</u> of remote load management results

Our real-time telephonic system plotted this 5-6MW industrial plant's voluntary compliance with the utility's telephoned request to reduce load during a summer peak. The plant reduced its load 10% within fifteen minutes, resuming full load four hours later when notified that the peak had passed.

Each data point represents electrical demand over a five-minute interval.



Customer P
June 10, 1993
Real-time measurement of load management results
6.3
6.2
6.1
6
5.9
5.8
5.7
5.6
5.5
5.4
5.3
5.2
5.1
5
4.9
4.8
4.7
4.6
4.5
4.4
00:09
02:09
04:09
06:09
08:09
10:09
12:09
14:09
16:09
18:09
20:09
22:09
Time of day, 24-hour clock
UTILITY REQUESTED LOAD CURTAILMENT
UTILITY REPORTED "ALL-CLEAR", PEAK PAST

Appendix 2

The views of a cooperating telephone company

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Sprint
Mid-Atlantic Telecom

Carolina Telephone
Centel-North Carolina
Centel-Virginia
United Telephone-Southeast

Writer's Telephone Number:

February 24, 1994

Mr. Charles J. Cain
President
UTILEX
P. O. Box 991
Greenville, NC 27834

Dear Charles:

Carolina Telephone recently concluded testing and evaluation of UTILEX's Automatic Meter Reading equipment. This testing involved placing your company's equipment on a variety of loop types including subscriber carrier fed residential POTS lines, an electronic key system line and a coin telephone line. During the more than ten months that this testing covered we could detect no detrimental effects on our network or the quality of service provided our customers.

We believe your approach to the transport of the AMR data to be unique and one that circumvents many of the problems found in other systems. It has been a pleasure working with you and your staff and we appreciate the insight you have given us in this area.

Sincerely,

Donald B. Gardner

Donald B. Gardner
Strategic Planner

Appendix 3

Business contact persons familiar with UTILEX's work

Attachment 6:

Business Contact Persons
Familiar with UTILEX's Activities

U.S. Dept. of Energy:

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